



AFB/2125

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
CHRISTOPHER A. BODE ET AL.

Serial No.: 09/824,301

Filed: April 2, 2001

For: METHOD AND APPARATUS FOR
INITIALIZING TOOL CONTROLLERS
BASED ON TOOL EVENT DATA

Examiner: SEAN P. SHECHTMAN

Group Art Unit: 2125

Att'y Docket: 2000.057800

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APPEAL BRIEF

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Sir:

Applicant hereby submits an original and two copies of this Appeal Brief to the Board of Patent Appeals and Interferences in response to the final Office Action dated October 17, 2003. Applicants also hereby petitions for a two-month extension of time to file this Appeal Brief.

The Assistant Commissioner is authorized to deduct the fee for filing this Appeal Brief (\$330) and for the two-month extension of time from **Advanced Micro Devices, Inc. Deposit Account No. 01-0365/TT4119**. In the event the monies in that account are insufficient, the Assistant Commissioner is authorized to withdraw funds from Williams, Morgan & Amerson, P.C. Deposit Account No. 50-0786/2000.057800.

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02 FC:1252

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I. REAL PARTY IN INTEREST

The present application is owned by Advanced Micro Devices, Inc. The assignment of the present application to Advanced Micro Devices, Inc., is recorded at Reel 11707, Frame 0843.

II. RELATED APPEALS AND INTERFERENCES

Applicant is not aware of any related appeals and/or interferences that might affect the outcome of this proceeding.

III. STATUS OF THE CLAIMS

Claims 1-45 are pending in the application. The claims as currently pending are attached as Appendix A. Claims 1-2, 6, 11, 17, 22, and 28-31 stand rejected under 35 U.S.C. § 103(a) as being obvious over United States Patent No. 5546312 (Mozmunder) in view of U.S. Pub. No. 2002/0116083 (Schulze). Claims 35 and 36 stand rejected under 35 U.S.C. § 103(a) as being obvious over Mozmunder and Schulze in further view of U.S. Pub. No. 2002/0147960 (Jevtic). Claims 3-5, 7-10, 12-16, 18-21, 23-27, 32-34, and 37-45 stand rejected as being obvious over Mozmunder and Schulze, or alternatively, over Mozmunder and Schulze in view of Jevtic and the article by Michael Quirk.

IV. STATUS OF AMENDMENTS

There were no amendments after the final rejections.

V. SUMMARY OF THE INVENTION

Processing tools used in semiconductor fabrication periodically undergo preventative maintenance procedures or calibrations to keep the tool in optimum operating condition. For example, polishing pads in polishing tools are periodically conditioned or replaced. Etch tools and deposition tools are periodically cleaned using both *in situ* cleans or complete disassembly cleans. Steppers are periodically calibrated to maintain alignment accuracy and exposure dose consistency. These discrete maintenance activities are collectively referred to as tool events.

Tool events often cause step changes in the processing characteristics of the tool. Control routines implemented by an automated process controller on the processing tool may experience problems as a result of the changes caused by the tool event. For example, a process controller for a chemical mechanical polishing (CMP) tool uses a blanket wafer removal rate of a polishing pad for modeling the performance (*e.g.*, polishing rate) of the polishing tool. The blanket wafer removal rate may change after a tool event such as pad conditioning or replacement, which may disrupt the model. If the process controller attempts to control the CMP tool under the new processing characteristics introduced by the tool event, the polishing process may be poorly controlled. In some cases, the tool event may even cause the control algorithm to become unstable.

The process control problems following the tool event may result in increased variation in wafer properties or even defective wafers. Over time, the process controller may compensate for the tool event by adjusting its performance model based on post-processing metrology feedback, but the wafers produced in the interim may be suspect. In some situations, the process controller might never be able to stabilize the process following the tool event. Similar control

problems may be experienced by process controllers on other tools. See Patent Application, page 4, line 10 - page 5, line 5.

Accordingly, Applicants describe and claim a method for initializing process controllers based on tool event data. The methods set forth in claims 1 and 17 include, among other things, providing a tool having a process controller adapted to employ a control model to control an operating recipe of the tool, receiving a tool event notification, and initializing the control model in response to receiving the tool event notification. Claim 28 sets forth a manufacturing system for implementing, in various embodiments, the methods set forth in claims 1 and 17.

As discussed starting on line 21 of page 9 of the Patent Application, initializing the process controller includes actions taken by a process controller in response to a tool event notification. The specific actions may vary depending on the nature of the tool event and the control abilities of the process controller. For example, in response to receiving the tool event notification, a process controller for a CMP tool may communicate with a process control server or a tool operator to force the processing of one or more test wafers to determine a new blanket wafer removal rate. Using the new blanket wafer removal rate, the process controller may initialize its control model for subsequent processing runs. See Patent Application, page 10, lines 4-15. For another example, historical data may allow the process controller to predict an approximate etch rate or deposition rate following an *in situ* cleaning of the chamber operation. The process controller may then use the approximate etch or deposition rate to initialize its control model for subsequent processing runs. See Patent Application, page 10, lines 16-22.

VI. ISSUE ON APPEAL

Appellant respectfully requests that the Board review and overturn the three rejections present in this case. The following issues are presented on appeal in this case:

(A) Whether claims 1, 2, 6, 11, 17, 22, and 28-31 are obvious over Mozmunder in view of Schulze;

(B) Whether claims 35 and 36 are obvious over Mozmunder and Schulze in further view of Jevtic; and

(C) Whether claims 3-5, 7-10, 12-16, 18-21, 23-27, 32-34, and 37-45 are obvious over Mozmunder and Schulze, or alternatively, over Mozmunder and Schulze in view of Jevtic and the article by Michael Quirk.

VII. GROUPING OF THE CLAIMS

For the issues presented above, claims 1-45 may be considered to stand or fall together.

VIII. ARGUMENT

A. Legal Standards

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all the claim limitations. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Third, there must be a reasonable expectation of success. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991); M.P.E.P. § 2142. Moreover, all the claim

limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974). If an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988); M.P.E.P. § 2143.03.

With respect to alleged obviousness, there must be something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination. *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561 (Fed. Cir. 1986). In fact, the absence of a suggestion to combine is dispositive in an obviousness determination. *Gambro Lundia AB v. Baxter Healthcare Corp.*, 110 F.3d 1573 (Fed. Cir. 1997). The mere fact that the prior art can be combined or modified does not make the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990); M.P.E.P. § 2143.01. The consistent criterion for determining obviousness is whether the prior art would have suggested to one of ordinary skill in the art that the process should be carried out and would have a reasonable likelihood of success, viewed in the light of the prior art. Both the suggestion and the expectation of success must be founded in the prior art, not in the Applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991); *In re O'Farrell*, 853 F.2d 894 (Fed. Cir. 1988); M.P.E.P. § 2142.

B. Claims 1, 2, 6, 11, 17, 22, and 28-31 are not obvious over Mozmunder in view of Schulze.

Mozmunder describes a technique for simultaneously controlling non-uniformity metrics in processing a discrete product, such as a wafer. The technique includes measuring one or more product quality parameters on first and second sets of products, such as first and second sets of

test wafers. Process models are then tuned to create tuned process models using the product quality parameters from the first and second set of products. A changed state of the processing may then be estimated and applied to subsequent sets of products. See Mozmunder, col. 9, ll. 48-67 and Figure 5. For example, a change of 5% in a delivered TEOS flow may be detected by observing a 2-sigma or larger difference between a predicted model deposition rate and an observed deposition rate on a test wafer. A controller may then use the tuning technique to compensate for the TEOS faults to bring the deposition rate within 1-sigma of the model protection. See Mozmunder, col. 8, ll. 47-61.

However, Appellants respectfully submit that Mozmunder appears to be completely silent with regard to a tool event notification. Thus, Mozmunder does not describe or suggest receiving a tool event notification or initializing the control model in response to receiving the tool event notification. Mozmunder states that tuning may be performed after a tool maintenance event or tool drift, but the tuning is performed in response to detecting a statistically significant difference between a predicted model deposition rate and an observed deposition rate caused by the resulting drift, and not in response to a tool event notification.

Schulze fails to correct this defect in Mozmunder. Schulze is concerned with determining an efficiency of a fabrication system by measuring the idle time of tools in the fabrication system. Accordingly, Schulze monitors operational states of each tool in the fabrication system. For example, the hierarchy of potential states may include six top-level states reflecting various idle conditions: Unscheduled Downtime, Scheduled Downtime, Engineering Time, Standby Time, Productive Time, and Non-Scheduled Time. See Schulze, paragraph 0055. However, the state model employed by Schulze is not a “control model to control an operating recipe of the tool.” The state model only reflects the availability and/or idle state of the tool and is not used to

control the operating recipe. Trigger events are only used to cause transitions between various productive and/or idle states, and as such have nothing to do with controlling the operating recipe of the tool.

For at least the aforementioned reasons, Appellants respectfully submit that the cited references, either alone or in combination, fail to disclose all of limitations of the claimed invention as set forth in claims 1, 2, 6, 11, 17, 22, and 28-31.

Appellants also respectfully submit that the cited references fail to teach or suggest modifying the prior art to arrive at the claimed invention. For example, Mozmunder does not teach or suggest receiving a tool event notification and initializing the control model in response to receiving the tool event notification. Instead, Mozmunder teaches that the problem of non-uniformity control may be solved by measuring one or more product quality parameters on first and second sets of products and then tuning the process models using the product quality parameters from the first and second set of products. Thus, the cited references fail to achieve one or more advantages of the present invention. For example, by proactively initializing the control model in response to the tool event notification instead of waiting until a non-conforming condition is identified, the present invention allows the model to be adjusted before a drift condition results, thereby increasing the quality of the items processed between the tool event and the drift identified by Mozmunder.

For at least the aforementioned reasons, Appellants respectfully submit that the Examiner has failed to make a *prima facie* case that claims 1, 2, 6, 11, 17, 22, and 28-31 are obvious over Mozmunder in view of Schulze.

C. Claims 35 and 36 are not obvious over Mozmunder and Schulze in further view of Jevtic.

Claims 35-36 depend from independent claim 28. In rejecting claims 35-36, the Examiner relies upon Jevtic to teach scheduling the periodic removal of wafers for testing. However, Jevtic fails to remedy the fundamental deficiencies of Mozmunder and Schulze discussed above with regard to claim 28. Thus, for at least the reasons discussed above with regard to independent claim 28, Appellants respectfully submit that the Examiner has failed to make a *prima facie* case that claims 35-36 are obvious over Mozmunder and Schulze in further view of Jevtic.

D. Claims 3-5, 7-10, 12-16, 18-21, 23-27, 32-34, and 37-45 are not obvious over Mozmunder and Schulze, or alternatively, over Mozmunder and Schulze in view of Jevtic and the article by Michael Quirk.

In rejecting claims 3-5, 7-10, 12-16, 18-21, 23-27, 32-34, and 37-45, the Examiner relies upon Jevtic to teach scheduling the periodic removal of wafers for testing. The Examiner also relies on the article by Michael Quirk to teach various processing tools that may be used during processing of semiconductor wafers. However, Jevtic and Quirk, either alone or in combination, fail to remedy the fundamental deficiencies of Mozmunder and Schulze discussed above. In particular, neither Jevtic nor Quirk teach or suggest receiving a tool event notification or initializing the control model in response to receiving the tool event notification. Thus, for at least the reasons discussed above, Appellants respectfully submit that the Examiner has failed to make a *prima facie* case that claims 3-5, 7-10, 12-16, 18-21, 23-27, 32-34, and 37-45 are obvious over Mozmunder and Schulze, or alternatively, over Mozmunder and Schulze in view of Jevtic and the Quirk article.

IX. CONCLUSION

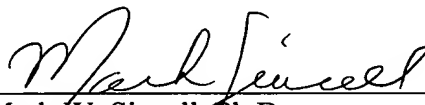
In view of the foregoing, it is respectfully submitted that the Examiner erred in not allowing all claims pending in the present application, claims 1-45, over the prior art of record. The undersigned may be contacted at (713) 934-4052 with respect to any questions, comments or suggestions relating to this appeal.

Respectfully submitted,

Date: 5/11/04



23720
PATENT TRADEMARK OFFICE



Mark W. Sincell, Ph.D.
WILLIAMS, MORGAN & AMERSON
10333 Richmond, Suite 1100
Houston, Texas 77042
(713) 934-7000
(713) 934-7011 (facsimile)

AGENT FOR APPLICANTS